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TITLE: LIQUID CRYSTAL DISPLAY DEVICE

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ABSTRACT:

PROBLEM TO BE SOLVED: To provide a liquid crystal display device in which an adjustment is easily made for dispersion in the voltage amplitudes of input video signals.

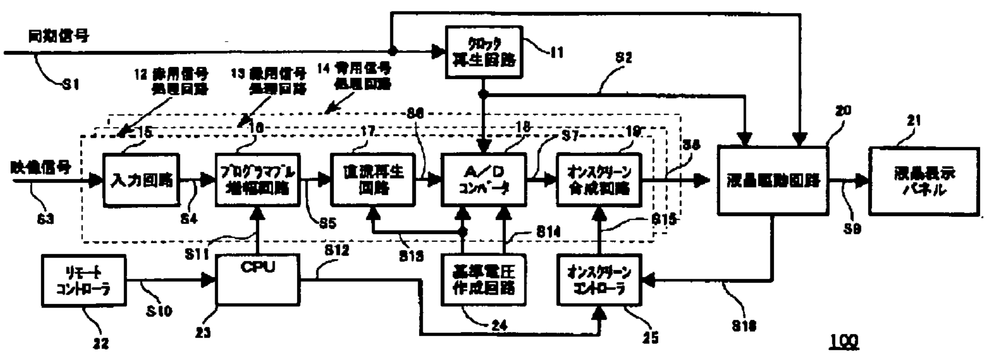
SOLUTION: When a compensation is to be made for the dispersion in the voltage amplitudes of input video signals, a maximum luminance test pattern, which is the object of comparison, is displayed in a portion of on-screen and an operator conducts an adjustment to reduce the difference between the test

pattern and the input picture to maximum luminance video signals. For example, a white input picture and a white (a maximum gradation) test pattern produced in a liquid crystal display device 100 are simultaneously displayed side by side on the screen. The operator adjusts the amplification of an amplifying circuit 16 and a reference voltage of an A/D converter 18 so as to eliminate the difference between the white input picture and the luminance of the white test pattern. Thus, the dispersion of the voltage amplitudes of input video signals and the device 100 is easily adjusted to provide an optimum display.

DRAWINGS

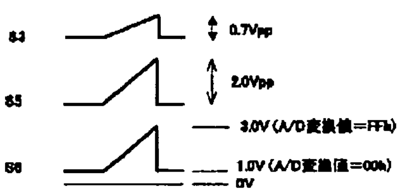
[Drawing 1]

本発明の第1の実施の形態の液晶表示装置の構成図



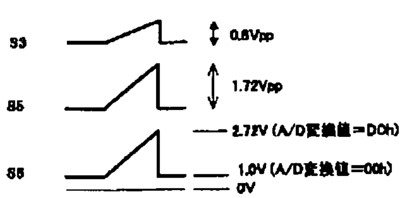
[Drawing 2]

本発明の第1の実施の形態の液晶表示装置の電圧波形図



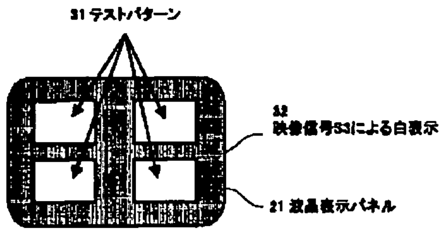
[Drawing 3]

本発明の第1の実施の形態の液晶表示装置の調整前の電圧波形図

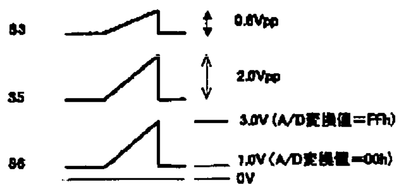


[Drawing 4]

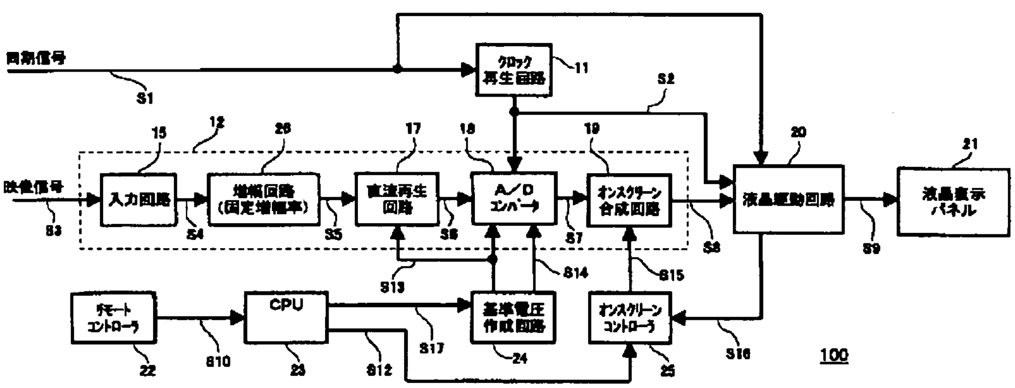
本発明の第1の実施の形態の液晶表示装置のオンスクリーンテストパターン図



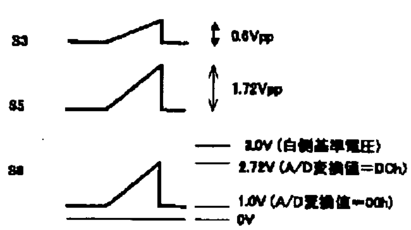
[Drawing 5]
本発明の第1の実施の形態の液晶表示装置の最適調整時の電圧波形図



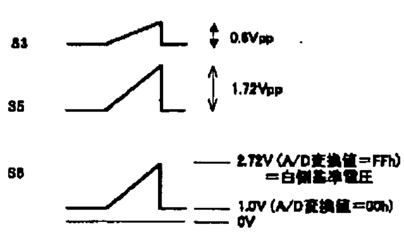
[Drawing 6]
本発明の第2の実施の形態の液晶表示装置の構成図



[Drawing 7]
本発明の第2の実施の形態の液晶表示装置の調整前の電圧波形図

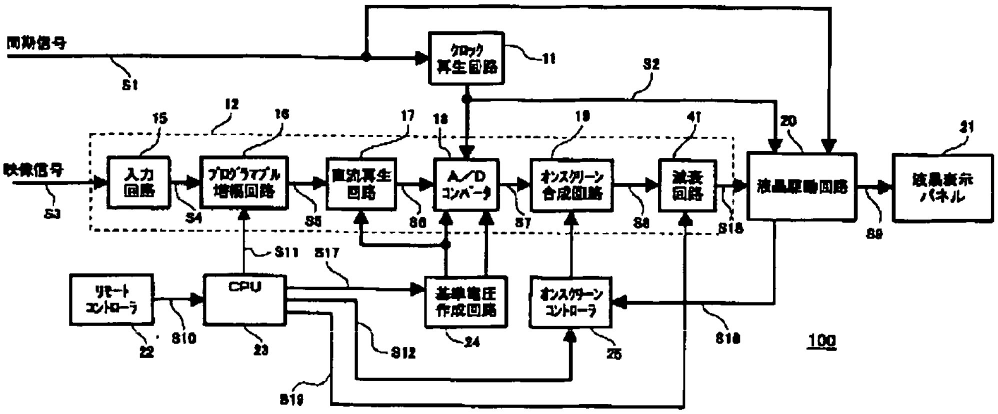


[Drawing 8]
本発明の第2の実施の形態の液晶表示装置の最適調整時の電圧波形図



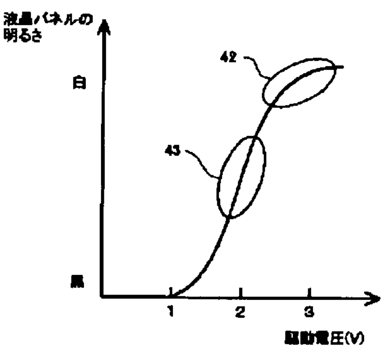
[Drawing 9]

本発明の第3の実施の形態の液晶表示装置の構成図



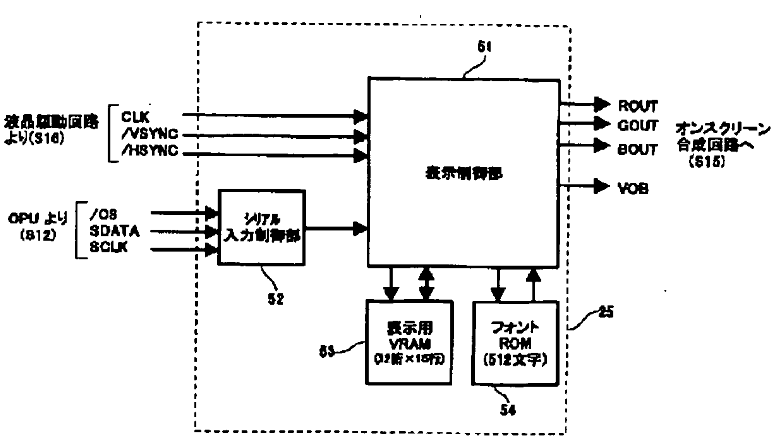
[Drawing 10]

本発明の第3の実施の形態の液晶表示装置の調整時の説明図



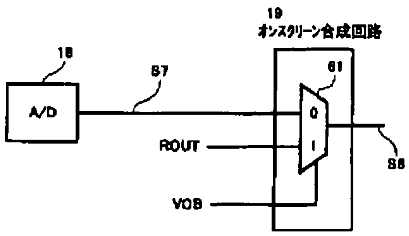
[Drawing 11]

本発明の実施の形態のオンスクリーンコントローラの構成図

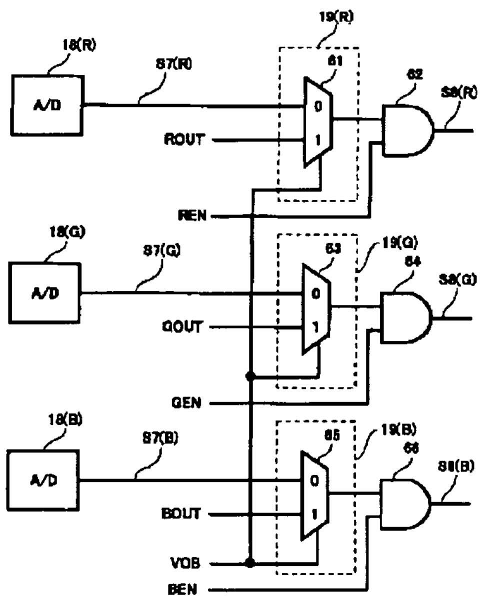


[Drawing 12]

本発明の実施の形態のオンスクリーン合成回路の構成図



[Drawing 13]
本発明の第4の実施の形態の液晶表示装置のオンスクリーン合成回路の構成図



[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a liquid crystal display and a liquid crystal display with the especially easy adjustment to the variation in the voltage swing of an input video signal.
[0002]
[Description of the Prior Art] A video signal is inputted from video-signal generation means, such as a television set and a video tape recorder, and a liquid crystal display displays the image on a liquid crystal panel. In this case, although specified that the video signal inputted from a video-signal generation means becomes a predetermined voltage swing, the variation in some exists by the model of video-signal generation means etc. Therefore, in order to demonstrate the gradation property of a liquid crystal display effectively, it is necessary to adjust the video signal inputted from a video-signal generation means to the optimal voltage swing by the liquid crystal display side.
[0003] Usually, a liquid crystal display changes into a digital signal the analog video signal inputted from a video-signal generation means by the A/D converter, and drives a liquid crystal panel with a digital signal. So, in the liquid crystal display, the voltage swing of the analog video signal before changing into a digital signal was adjusted, and the variation in the video signal inputted from a video-signal generation means is amended.
[0004] Here, an A/D converter changes the analog signal into a full-scale digital signal, when the analog signal of the specified voltage swing is inputted. For example, suppose that the voltage swing of the video signal which is inputted from a video-signal generation means in the case of the specification in which an A/D converter demonstrates the resolution of 256 gradation by 8 bits when the video signal of voltage swing 2V is inputted is 0.7V. in this case, the video signal inputted from a video-signal generation means -- 2V/0.7 -- if it amplifies in an amplifying circuit with one V = about 2.86 times the amplification factor of this and inputs into an A/D converter, an A/D converter can change that video signal into a full-scale digital signal.
[0005] On the other hand, when the voltage swing of the video signal inputted from a video-signal generation means is 0.8V, in the amplifying circuit it is about 2.86 times whose amplification factor of this, the voltage swing inputted into an A/D converter will become 0.8Vx2.86 time =2.29V. In this case, since the voltage swing of the video signal inputted into an A/D converter is over 2.0V, the output of an A/D converter is saturated and cannot reproduce gradation level of the video signal inputted correctly.
[0006] Conversely, when the voltage swing of the video signal inputted from a video-signal generation means is 0.6V, the voltage swing inputted into an A/D converter is set to 0.6Vx2.86 time =1.72V. In this case, 256 gradation which is the resolution of an A/D converter will not be able to be harnessed, but the color number displayed will become fewer.
[0007] Therefore, in order to amend the variation in the voltage swing of the video signal inputted from a video-signal generation means, the user needed to adjust the amplification factor of the amplifying circuit which amplifies a video signal to the optimum value, looking at the screen displayed by the video-signal generation means.
[0008]
[Problem(s) to be Solved by the Invention] Thus, conventionally, the video signal of the highest brightness, for example, white, was inputted into the liquid crystal display from the video-signal generation means, and while the user looked at the display of the white displayed with a liquid crystal display, the amplification factor of an amplifying circuit was adjusted.
[0009] However, although the amplification factor of an amplifying circuit needed to be adjusted judging whether the

output of an A/D converter is saturated by the user, and whether the gradation of an A/D converter has fully come out in order for a liquid crystal display to realize exact color reproduction nature, it was very difficult [it] to make the absolute brightness reliance and to adjust an amplification factor the optimal, looking at the display of the white in the display screen.

[0010] Then, this invention aims to let the adjustment to the variation in the voltage swing of an input video signal offer an easy liquid crystal display.

[0011]

[Means for Solving the Problem] The above-mentioned purpose is attained by offering the liquid crystal display with which an operator can perform optimal adjustment easily by displaying on some fields of ONSUKURIN the test pattern of the maximum brightness set as the comparative object, and making it adjust to an operator so that the difference of this test pattern and the input image to the video signal of the maximum brightness may be abolished, in case the variation in the voltage swing of an input video signal is amended.

[0012] According to this invention, a white (the maximum brightness) input image and the white (the maximum gradation) test pattern made within a liquid crystal display are displayed on onscreen **** coincidence side by side, for example. An operator adjusts the amplification factor of an amplifying circuit, and the reference voltage of an A/D converter so that the difference of the brightness of a white input image and a white test pattern may be lost. Although human being's eyes are difficult for identifying the absolute value of brightness, the capacity to identify few [****** brightness] differences is excellent. Thereby, the variation in the voltage swing of an input video signal is amended, and it becomes easy to adjust a liquid crystal display so that the optimal display may be performed.

[0013] Moreover, the amplifying circuit where the above-mentioned purpose amplifies an analog video signal and the A/D converter which changes the output signal of said amplifying circuit into a digital signal, The digital disposal circuit which has the onscreen composition circuit which compounds the output signal and onscreen status signal of said A/D converter, In the liquid crystal display which has the liquid crystal panel which performs a predetermined display according to the digitized output of said digital disposal circuit said digital disposal circuit Said digitized output which displays the field corresponding to the maximum of said analog video signal and the test pattern of the maximum gradation level on a display screen at coincidence is generated. Answer an input from an operator and the amplification factor of said amplifying circuit is changed. It is attained by offering the liquid crystal display characterized by making the output signal of said amplifying circuit corresponding to the maximum of said analog video signal correspond to the input voltage to the maximum gradation level of said A/D converter.

[0014] According to this invention, in case the amplification factor of an amplifying circuit is adjusted, the field corresponding to the maximum of an analog video signal and the test pattern of the maximum gradation level are displayed on a display screen at coincidence, and it adjusts so that the difference of the brightness of the field corresponding to the maximum of an analog video signal and a test pattern may be abolished. Therefore, an operator can adjust the amplification factor of an amplifying circuit easily, looking at an onscreen display, and even if variation is in the voltage swing of the video signal inputted from a video-signal generation means, he can adjust the input voltage of an A/D converter to the optimal value.

[0015] Moreover, the amplifying circuit where the above-mentioned purpose amplifies an analog video signal and the A/D converter which changes the output signal of said amplifying circuit into a digital signal, The digital disposal circuit which has the onscreen composition circuit which compounds the output signal and onscreen status signal of said A/D converter, In the liquid crystal display which has the liquid crystal panel which performs a predetermined display according to the digitized output of said digital disposal circuit said digital disposal circuit Said digitized output which displays the field corresponding to the maximum of said analog video signal and the test pattern of the maximum gradation level on a display screen at coincidence is generated. Answer an input from an operator and the reference voltage of said A/D converter is changed. It is attained by offering the liquid crystal display characterized by making the input voltage to the maximum gradation level of said A/D converter correspond to the output signal of said amplifying circuit corresponding to the maximum of said analog video signal.

[0016] According to this invention, the field corresponding to the maximum of an analog video signal and the test pattern of the maximum gradation level are displayed on a display screen at coincidence, and the reference voltage of an A/D converter is adjusted so that the difference of the brightness of the field corresponding to the maximum of an analog video signal and a test pattern may be abolished. Therefore, an operator can adjust the reference voltage of an A/D converter easily, looking at an onscreen display, and even if variation is in the voltage swing of the analog video

signal inputted from the video-signal generation means, he can use resolution of an A/D converter as a full scale.
[0017]
[Embodiment of the Invention] Hereafter, the example of the gestalt of operation of this invention is explained according to a drawing. However, the example of a gestalt of this operation does not limit the technical range of this invention.
[0018] Drawing 1 is the block diagram of the liquid crystal display of the gestalt of operation of the 1st of this invention. The digital disposal circuit 12 for red into which, as for a liquid crystal display 100, the red video signal S3 is inputted, green [which it does not illustrate], the digital disposal circuit 13 for green into which a blue video signal is inputted, respectively, and the digital disposal circuit 14 for blue, The clock regenerative circuit 11 which generates a clock signal S2 from a synchronizing signal S1, The reference voltage creation circuit 24 which generates the reference voltage of A/D converter 18, It has CPU23 which controls the amplification factor of the programmable amplifying circuit 16 etc., the onscreen controller 25 which generates the onscreen status signal S15, the liquid crystal drive circuit 20 which generates liquid crystal driving signal S9, and the liquid crystal display panel 21 which displays an image. Moreover, a remote controller 22 outputs various kinds of remote control signals S10 to CPU23.
[0019] The digital disposal circuit 12 for red has the onscreen composition circuit 19 which compounds the input circuit 15 where the red video signal S3 is inputted, the programmable amplifying circuit 16 which amplifies video-signal S4, the direct-current regenerative circuit 17 which adds a dc component to a video signal S5, A/D converter 18 which changes the analog video signal S6 into a digital signal, and the digital video signal S7 and the onscreen status signal S15. In addition, the digital disposal circuit 13 for green and the digital disposal circuit 14 for blue have the same configuration as the digital disposal circuit 12 for red.
[0020] Next, actuation of a liquid crystal display 100 is explained. The red analog video signal S3 inputted from the video-signal generation means which is not illustrated is inputted into the digital disposal circuits 12, 13, and 14 for red, green, and blue with the video signal of green and blue, respectively. CPU11 answers the remote control signal S10 from a remote controller 22, and outputs the control signal S11 common to each programmable amplifying circuit 16 of red, green, and each processing circuits 12, 13, and 14 for blue, and the gestalt of the 1st operation adjusts the amplification factor in common.
[0021] Here, suppose that the voltage swing of the analog video signal S3 inputted from a video-signal generation means is 0.7V. Analog video-signal S4 removed in the noise in the input circuit 15 which consists of a terminator and a filter is inputted into the programmable amplifying circuit 16 adjustable in an amplification factor. The amplification factor of the programmable amplifying circuit 16 is adjusted so that the voltage swing of the analog video signal S5 which is the output may turn into input voltage amplitude of a convention of A/D converter 18.
[0022] A/D converter 18 shall be changed into the digital signal of 256 gradation with the highest resolving power, i.e., 8 bits, when the analog signal of minimum input voltage 1.0V and highest input voltage 3.0V is inputted. Therefore, when the video signal S3 of voltage swing 0.7V is now inputted from a video-signal generation means, the amplification factor of the programmable amplifying circuit 16 is set up about 2.86 times, and it adjusts so that the voltage swing of the video signal S6 inputted into A/D converter 18 may be set to 2.0V.
[0023] On the other hand, since the analog video signal S5 from the programmable amplifying circuit 16 is outputted by the AC coupling by the capacitor, direct current level has not decided it. Then, the analog video signal S5 from the programmable amplifying circuit 16 is inputted into the direct-current regenerative circuit 17, and direct current level is reproduced. The direct-current regenerative circuit 17 clamps the black level (the minimum intensity level) of the analog video signal S5 with the black side reference voltage S13 (1.0V) generated in the reference voltage creation circuit 24. Thereby, the white level (the maximum intensity level) of the analog video signal S5 of voltage swing 2V becomes the white side reference voltage S14 (3.0V) and this potential of A/D converter 18. In addition, the black side reference voltage S13 (1.0V) generated in the reference voltage creation circuit 24 and the white side reference voltage S14 (3.0V) are supplied to A/D converter 18.
[0024] Moreover, the synchronizing signal S1 inputted from a video-signal generation means is inputted into the clock regenerative circuit 11 and the liquid crystal drive circuit 20, and the clock regenerative circuit 11 generates the clock signal S2 which carried out phase simulation to the synchronizing signal S1, and it outputs it to A/D converter 18 grade. The digital video signal S7 changed into the digital signal by A/D converter 18 is compounded in the onscreen composition circuit 19 with the onscreen status signal S15 inputted from the onscreen controller 25. The compounded digital video signal S8 is inputted into the liquid crystal drive circuit 20, is changed into liquid crystal driving signal S9,

and is outputted to the liquid crystal display panel 21.
[0025] A remote controller 22 outputs the remote control signal S10 to CPU23, and makes various kinds of control perform to CPU23. CPU23 answers a control signal S10 from a remote controller 22, outputs a control signal S11 to the programmable amplifying circuit 16, and controls the amplification factor of the programmable amplifying circuit 16 while it outputs a control signal S12 to the onscreen controller 25 and performs onscreen control.
[0026] Drawing 2 is an electrical-potential-difference wave form chart in case the voltage swing of a video signal is reference condition in the liquid crystal display of the gestalt of operation of the 1st of this invention. That is, the analog video signal S3 of voltage swing 0.7V inputted from a video-signal generation means passes through an input circuit 15, is amplified about 2.86 times in the programmable amplifying circuit 16, and turns into the analog video signal S5 of voltage swing 2.0V. A dc component is added to the analog video signal S5 in the direct-current regenerative circuit 17, and a voltage swing becomes the analog video signal S6 of 3.0V from 1.0V. Since this analog video signal S6 is inputted into A/D converter 18, the digital video signal S7 is changed into the full-scale digital value of FFh from 00h.
[0027] Drawing 3 is an electrical-potential-difference wave form chart when the analog video signal S3 of the amplitude smaller than a certified value is inputted into the liquid crystal display of the gestalt of operation of the 1st of this invention. When the voltage swing of the analog video signal S3 inputted from a video-signal generation means is 0.6V, the voltage swing of the analog video signal S5 outputted [that the amplification factor of the programmable amplifying circuit 16 continues being about 2.86 times the standard condition and] from the programmable amplifying circuit 16 is set to 1.72V. Therefore, the highest input voltage of the analog video signal S6 inputted into A/D converter 18 is set to about 2.72 V, this digital conversion value cannot be set to DCh, and the full scale of 256 gradation which A/D converter 18 has cannot be harnessed. That is, the digital conversion values DCh are D= 13 and C= 12, and are narrower than 256 gradation only corresponding to C= Dx16+220 gradation.
[0028] Then, it is necessary to adjust the amplification factor of the programmable amplifying circuit 16, and to set the voltage swing of a video signal S5 to 2.0V. In this case, with the gestalt of this operation, while making the display screen of the liquid crystal display panel 21 indicate by white in the largest possible field 32 with the analog video signal S3 over the maximum brightness inputted from a video-signal generation means as shown, for example in drawing 4 (the maximum brightness display), the test pattern 31 is indicated by onscreen one. Let the test pattern 31 at this time be a white pattern equivalent to the maximum gradation level FFh (256 gradation).
[0029] Next, an operator outputs the remote control signal S10 to CPU23 from a remote controller 22, and adjusts the amplification factor of the programmable amplifying circuit 16. If the amplification factor of the programmable amplifying circuit 16 is gathered gradually, the difference of the brightness of the white viewing area 32 by the video signal S3 inputted from the video-signal generation means and the test pattern 31 overwritten by it will become small gradually. An amplification factor becomes the optimal where this difference is lost.
[0030] Drawing 5 is an electrical-potential-difference wave form chart at the time of adjusting the amplification factor of the programmable amplifying circuit 16 the optimal, when the analog video signal S3 of the amplitude smaller than a certified value is inputted. Even if the voltage swing of the video signal S3 inputted from a video-signal generation means is 0.6V, the voltage swing of the analog video signal S5 of the output is set to 2.0V by adjusting the amplification factor of the programmable amplifying circuit 16 about 3.33 times. Therefore, the highest input voltage of the analog video signal S6 inputted into A/D converter 18 is set to 3.0V, and can be changed into the full-scale digital value to FFh from 00h.
[0031] However, if the amplification factor of the programmable amplifying circuit 16 is gathered further, the voltage swing of the analog video signal S6 inputted into A/D converter 18 will cross the convention range, with no difference of the brightness of the white viewing area 32 by the video signal S3, and a test pattern 31. Thus, when the amplification factor of the programmable amplifying circuit 16 is gathered too much, an amplification factor is once lowered, and after giving the brightness difference of the white viewing area 32 and a test pattern 31 by the video signal S3, it is necessary to gather and adjust an amplification factor again.
[0032] Moreover, also when the voltage swing of the video signal S3 inputted from a video-signal generation means is larger than 0.7V, after once lowering an amplification factor and giving the brightness difference of the white viewing area 32 and a test pattern 31 by the video signal S3 like the above-mentioned, it adjusts. In addition, even if the white viewing area 32 by the analog video signal S3 is not the white display across which it goes all over the liquid crystal display panel 21, the part which laps with a test pattern 31 to some extent, and can be compared just white-displays it.

[0033] Thus, with the gestalt of this operation, in case the amplification factor of the programmable amplifying circuit 16 is adjusted, the test pattern 31 of the maximum gradation level is indicated by onscreen one on the white viewing area 32 by the analog video signal S3 of the maximum brightness, and it adjusts so that the boundary of the white viewing area 32 and a test pattern 31 may be abolished. Therefore, an operator can adjust the amplification factor of the programmable amplifying circuit 16 easily, looking at an onscreen display, and even if variation is in the voltage swing of the video signal S3 inputted from a video-signal generation means, he can adjust the input voltage of A/D converter 18 to the optimal value.
[0034] Drawing 6 is the block diagram of the liquid crystal display of the gestalt of operation of the 2nd of this invention. Although the liquid crystal display 100 of the gestalt of the 2nd operation has the same configuration as the gestalt of the 1st operation, and abbreviation, it replaces with the programmable amplifying circuit 16, and the amplifying circuit 26 of a fixed amplification factor is formed, and the point that CPU23 outputs a control signal S17 to the reference voltage creation circuit 24 is different. In addition, drawing 6 shows only the digital disposal circuit 12 for red.
[0035] With the gestalt of the 2nd operation, the amplification factor of an amplifying circuit 26 is fixed, reference voltage for the A/D conversion of A/D converter 18 is made adjustable, and even if variation is in the voltage swing of the analog video signal S3 inputted from a video-signal generation means, the digital video signal S7 outputted from A/D converter 18 is changed into the full-scale digital value of FFh from 00h. That is, the input voltage of A/D converter 18 corresponding to the maximum digital value is matched with the signal S6 corresponding to the analog video signal S3 of the maximum brightness. The fixed amplification factor of an amplifying circuit 26 presupposes that it is set up about 2.86 times like the gestalt of the 1st operation here.
[0036] Drawing 7 is an electrical-potential-difference wave form chart before adjustment when the analog video signal S3 smaller than a certified value is inputted from a video-signal generation means in the gestalt of the 2nd operation. When the voltage swing of the analog video signal S3 inputted from a video-signal generation means is 0.6V, the voltage swing of the analog video signal S5 outputted from an amplifying circuit 26 is set to 1.72V, and the highest input voltage of the analog video signal S6 inputted into A/D converter 18 is set to 2.72V. Here, supposing the reference voltage by the side of the white of A/D converter 18 (the maximum brightness side) is set as 3.0V, since highest input voltage 2.72V of the analog video signal S6 do not reach reference voltage 3.0V by the side of white, the resolution of 256 gradation will not be obtained.
[0037] In this case, although an operator adjusts so that the boundary of the test pattern 31 by which it was indicated by onscreen one with the white viewing area 32 by the analog video signal S3 of a video-signal generation means may be lost like the gestalt of the 1st operation, with the gestalt of the 2nd operation, he adjusts the reference voltage by the side of the white of A/D converter 18 rather than adjusts the amplification factor of the programmable amplifier 16.
[0038] Drawing 8 is an electrical-potential-difference wave form chart at the time of adjusting the reference voltage by the side of the white of A/D converter 18 the optimal in the gestalt of the 2nd operation. Although the voltage swing of the analog video signals S3, S5, and S6 is the same as adjustment before, the reference voltage by the side of the white of A/D converter 18 is adjusted to 2.72V [equal to the highest input voltage of the analog video signal S6 inputted into A/D converter 18]. Therefore, A/D converter 18 is convertible for the full-scale digital value of FFh from 00h, even if the highest input voltage of the analog video signal S6 is 2.72V.
[0039] Thus, with the gestalt of the 2nd operation, the test pattern 31 of the maximum gradation level is indicated by onscreen one like the case of drawing 4 on the white viewing area 32 by the analog video signal S3, and the reference voltage by the side of the white of A/D converter 18 is adjusted so that the boundary of the white viewing area 32 and a test pattern 31 may be abolished. Therefore, an operator can adjust easily the reference voltage by the side of the white of A/D converter 18, looking at an onscreen display, and even if variation is in the voltage swing of the analog video signal S3 inputted from the video-signal generation means, he can use resolution of A/D converter 18 as a full scale.
[0040] Drawing 9 is the block diagram of the liquid crystal display of the gestalt of operation of the 3rd of this invention. Although the liquid crystal display 100 of the gestalt of the 3rd operation has the same configuration as the 1st, or the gestalt of the 2nd operation and abbreviation, the point of having formed the attenuation circuit 41 between the onscreen composition circuit 19 and the liquid crystal drive circuit 20 is different. In addition, drawing 9 shows only the digital disposal circuit 12 for red.
[0041] In case this adjusts the reference voltage by the side of the amplification factor of the programmable amplifying circuit 16, or the white of A/D converter 18, it notes the point which having looked at the difference of halftone tends to

adjust rather than seeing and adjusting the difference of a white display of high brightness. Moreover, it is because change of brightness becomes large to change of driver voltage and it becomes easy to adjust the property of the brightness of the liquid crystal display panel 21, since an inclination becomes sudden from the high brightness field 42 as for the halftone field 43 as shown in drawing 10 .
[0042] An attenuation circuit 41 attenuates the digital video signal S8 outputted from the onscreen composition circuit 19, and is outputted to the liquid crystal drive circuit 20. Thereby, it becomes easier to distinguish the difference of the brightness of the white viewing area 32 by the analog video signal S3 shown in drawing 4 , and the onscreen ****** test pattern 31, and adjustment of the reference voltage by the side of the amplification factor of the programmable amplifying circuit 16 or the white of A/D converter 18 becomes still easier.
[0043] Drawing 11 is the concrete block diagram of the onscreen controller 25 of the gestalt of operation of this invention. The onscreen controller 25 receives the control signal S12 outputted from CPU23 in the serial input-control section 52. The serial data signal SDATA which are the chip select signal/CS for device selection, and onscreen data, and serial clock signal SCLK are contained in a control signal S12. The serial input-control section 52 receives the serial data signal SDATA and serial clock signal SCLK, when a chip select signal/CS is L level. In this case, CPU23 transmits the serial data signal SDATA synchronizing with serial clock signal SCLK, and makes a change of a setup of the onscreen controller 25, and a setup.
[0044] The character font of 512 characters decided beforehand, for example, the alphabetic character in which one character consists of 12x18 dots, is stored in the font ROM 54. Moreover, VRAM53 for a display stores data, such as a location of the screen data which constitute ONSUKURIN, for example, the alphabetic character displayed by ONSUKURIN, and the number of alphabetic characters. VRAM53 for a display is set up by the control signal S12 from CPU23.
[0045] Horizontal Synchronizing signal HSYNC, Vertical Synchronizing signal VSYNC, and a clock signal CLK are supplied to a display and control section 51 from the liquid crystal drive circuit 20, it reads the data of an onscreen display from VRAM53 for a display, and a font ROM 54, and outputs red, green, blue onscreen data signal ROUT, GOUT, BOUT, and the onscreen control signal VOB to the onscreen composition circuit 19.
[0046] In addition, the onscreen control signal VOB controls whether an onscreen display is performed in the onscreen composition circuit 19. That is, when the onscreen control signal VOB is H level, an onscreen display is performed, and an onscreen display is not performed when the onscreen control signal VOB is L level.
[0047] Drawing 12 is the concrete block diagram of the onscreen composition circuit 19 for the red of the gestalt of this operation. Onscreen data signal ROUT is compounded with the digital video signal S7 inputted by the multiplexer 61 from A/D converter 18. In this case, when the onscreen control signal VOB is H level, the onscreen composition circuit 19 compounds onscreen data signal ROUT to the digital video signal S7, it outputs, and when the onscreen control signal VOB is L level, only the digital video signal S7 is outputted.
[0048] Drawing 13 is the block diagram of the onscreen composition circuit 19 used with the liquid crystal display of the gestalt of the 4th operation. With the gestalt of the 4th operation, NAND circuits 62, 64, and 66 are established in the output side of red, green, and the onscreen composition circuit 19 for blue. Other 4th configuration of the gestalt of operation is the same as that of the gestalt of the 1st thru/or the 3rd operation.
[0049] With the gestalt of the 1st thru/or the 3rd operation, although the reference voltage by the side of the amplification factor of the programmable amplifying circuit 16 or the white of A/D converter 18 was adjusted in common by each digital disposal circuits 12, 13, and 14 for red, green, and blue, to carry out still stricter adjustment, it is necessary to adjust each digital disposal circuits 12, 13, and 14 for red, green, and blue according to an individual.
[0050] With the gestalt of the 4th operation, the analog video signal S3 which displays white on the fixed range of the liquid crystal display panel 21 from a video-signal generation means is inputted like the gestalt of the 1st thru/or the 3rd operation. And when adjusting red, while making the onscreen control signal VOB into H level and making an onscreen display perform, the green mask signal GEN and the blue mask signal BEN are made into L level, and the green digital video signal S7 (G) and the blue digital video signal S7 (B) are compulsorily changed to the minimum level. Thereby, a red image is displayed on the liquid crystal display panel 21. And it adjusts so that the boundary of the display by the red digital video signal S7 (R) and a display of the test pattern 31 of the red of the maximum gradation may be lost like the above-mentioned adjustment. When carrying out green adjustment, the blue digital video signal S7 (R) and S7 (B) are made into the minimum level with red, and in adjusting blue, it adjusts by making red, the green digital video signal S7 (R), and S7 (G) into the minimum level.

[0051] Thus, with the gestalt of the 4th operation, after that the red by the analog video signal S3, green, and blue display, the test pattern 31 of the red of the maximum gradation level, green, and blue is indicated by onscreen one, and it adjusts so that the boundary may be abolished. Therefore, an operator can adjust easily the amplification factor of the programmable amplifying circuit 16, or the reference voltage of A/D converter 18, looking at an onscreen display, and even if variation is in the voltage swing of green [which were inputted from the video-signal generation means / the red and green], and a blue analog video signal, he can adjust the input voltage of A/D converter 18 for red, green, and blue to the optimal value.

[0052]

[Effect of the Invention] Since the amplification factor of an amplifying circuit or the reference voltage of an A/D converter is adjusted according to this invention so that the test pattern by the digital video signal of the maximum gradation set as the comparative object with the viewing area by the input video signal of the maximum brightness may be displayed on some fields of ONSUKURIN and the boundary of the viewing area by this test pattern and the input video signal may be abolished as explained above, the adjustment to the variation in the voltage swing of an input video signal becomes easy.

[Translation done.]